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Using Thoreau, scientists measure the impact of climate change on wildflowers

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Source: University of Tennessee at Knoxville

Summary: A new study is using observations made by Henry David Thoreau -- 19th-century American naturalist, social reformer, and philosopher -- to explore the effects of climate change on tree leaf-out and, as a result, the emergence of spring wildflowers.

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FULL STORY

A new study published in *Ecology Letters* is using observations made by Henry David Thoreau -- 19th-century American naturalist, social reformer, and philosopher -- to explore the effects of climate change on tree leaf-out and, as a result, the emergence of spring wildflowers.

The paper was coauthored by Susan Kalisz, head of the University of Tennessee, Knoxville's Department of Ecology and Evolutionary Biology, and Mason Heberling, a National Science Foundation postdoctoral research fellow affiliated with UT. Researchers from the University of Maine, Boston University, and Syracuse University also participated in the research.

The study draws on scientific observations initiated by Thoreau in Concord, Massachusetts, in the 1850s. These observations, combined with current research, include tree and wildflower leaf-out dates measured for 37 separate years between 1852 to 2018.

"Leaf-out" refers to the time of spring in which a species of plant begins producing leaves. A change in the timing of this stage has downstream consequences for other elements of the ecosystem.

Temperatures in Concord have warmed by 3 degrees Celsius (5 degrees Fahrenheit) over the past century. In this same time period, tree and wildflower leaf-out dates have shifted significantly.

"Wildflowers are now leafing out about one week earlier than 160 years ago, but the trees are leafing out two weeks earlier," said Caitlin McDonough MacKenzie of Boston University. "Understory wildflowers need the sunny conditions before the trees leaf out for their energy budgets."

To understand the impact that tree leaf-out could have on wildflower growth, the research team compared the Concord observations to photosynthesis data collected by Heberling and Kalisz in a forest in Fox Chapel, Pennsylvania, as part of a long-term field experiment.

"Long-term research is invaluable for detecting changes that cannot be quantified over shorter time scales," said Kalisz.

By adapting these measurements, the team calculated how temperature-driven shifts in tree leaf-out have affected wildflowers from Thoreau's time until now.

"Combining our work from Pittsburgh with Thoreau's data revealed an overlooked yet critical implication of how our changing climate is affecting native wildflowers beloved by so many people" Heberling said.

The combined analysis shows that wildflowers and trees differ in the way their leaf-out patterns respond to climate change, and those differences could already be hindering wildflower abundance and flowering, with greater effects in coming years.

As the climate warms, the window of time between wildflower emergence and tree leaf-out will likely shorten further, leaving wildflowers less time to photosynthesize in the spring. Current climate models predict a temperature increase of 2.5 to 4.5 degrees Celsius (4 to 8 degrees Fahrenheit) in the northeastern US by 2080 -- potentially more than double the temperature increase that has been observed over the past century.

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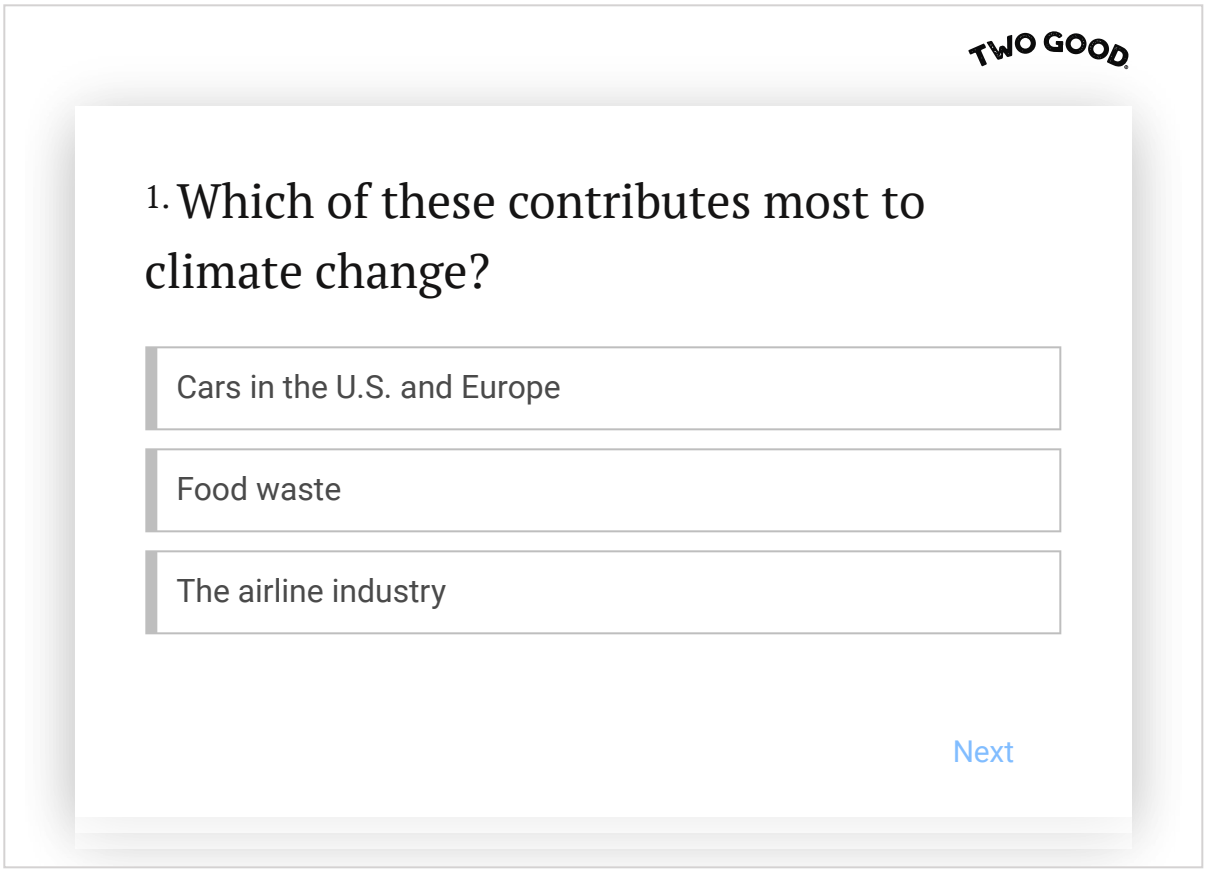

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Materials provided by **University of Tennessee at Knoxville**. *Note: Content may be edited for style and length.*

Journal Reference:

1. J. Mason Heberling, Caitlin McDonough MacKenzie, Jason D. Fridley, Susan Kalisz, Richard B. Primack. **Phenological mismatch with trees reduces wildflower carbon budgets**. *Ecology Letters*, 2019; 22 (4): 616 DOI: 10.1111/ele.13224

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